Association of Transportation Safety Information Professionals

Application for Best Practices Recognition, 2004

Submitted by the
Governor's Highway Safety Bureau
One Ashburton Place, Room 611
Boston, MA 02108

February, 2004

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Part One: Project Summary

Project Title

Massachusetts Data Warehouse and Interactive Data Retrieval System

Project Description

Massachusetts has created a data warehouse that houses crash-related data from a variety of resources/state agencies to be used in problem identification and program design, implementation and evaluation. Access has been provided to transportation safety professionals through an online Interactive Data Retrieval System. (https://www2.massghsb.com/logon.aspx)

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Lead Agency for Project

- Massachusetts Governor's Highway Safety Bureau (GHSB), a program of the Executive Office of Public Safety (EOPS)
- Massachusetts Highway Department (MassHighway)

Participating/Cooperating Agencies (if any)

- Massachusetts Traffic Safety Research Program (MassSAFE)
- Massachusetts Registry of Motor Vehicles (RMV)

Applicable National Agenda Goals

1, 2, 3, 4, and 5

Supported Steps in the Management Process

(1) Establish Safety Goals; (2) Identify Problems; (3) Plan Programs/Countermeasures; (4) Implement Programs; and (6) Evaluate Effectiveness.

Applicable Priorities from Traffic Records Strategic Plan

- Solidify the organizational structure for guiding improvements to Massachusetts' Traffic Records System to develop a mechanism for improving the ability of Massachusetts Traffic Records System to support the information needs of state, regional, and local organizations with a traffic safety function.

- Enhance analytic capabilities of the user population to help all users of traffic records to become educated customers who ultimately will help drive system improvements needed in the future.

- Promote improved acquisition, migration, and access to information for all users to develop the desired traffic records system and to modify the existing system to conform with this model.

Project Cost

Planned $: $300,000 over three years Actual $: $300,000 over three years

Extent of Project Implementation

Massachusetts Data Warehouse

As of Spring 2004, the Massachusetts Data Warehouse had developed working relationships with multiple data owners and acquired, prepared and loaded the data sets listed in the table below.

Data Set	Years	Data Source
Crash Data (ALARS)	1990-2001	Registry of Motor Vehicles
Crash Data System (CDS)*	2002	Registry of Motor Vehicles
Commercial Motor Vehicle Crash Data and Supplemental Form	1993-2002	Massachusetts State Police
Commercial Motor Vehicle Inspection Data	1999-2002	Massachusetts State Police
Death Certificate Data	1990-2001	Department of Public Health
Citation Data	1977-2003	Registry of Motor Vehicles
Emergency Department Data	FY 2001	Division of Health Care Finance and Policy
Outpatient Observation Data	1999-2001	Division of Health Care Finance and Policy
Inpatient Discharge Data	FY 1998-FY 2002	Division of Health Care Finance and Policy
Massachusetts Fire Incident Reporting System (crash auto fires)	2001-2003	Department of Fire Services

* The CDS system is crash data resulting from a new crash report form. CDS data is different from previous crash data in that it conforms with MMUCC guidelines and contains more crash attributes than the previous ALARS data.

Detailed crash location data will be provided in Fall, 2004 by MassHighway and will be added at that time.

Interactive Data Retrieval System

In addition, the Interactive Data Retrieval System which provides internet-based access to online query tools for crash data, commercial vehicle crash data, commercial vehicle inspection data, and citation data was developed. The Interactive Data Retrieval System has been beta tested and is accessed by traffic safety stakeholders from 50 agencies.

Summary of Project Benefits: What was improved, who benefited, and how?

What was improved:

- Collaboration between state agencies and data owners
- Centralized repository for crash-related data
- Data quality as a result of cleaning process prior to loading
- Access to data for users of all skill levels
- Tools for analysis of data by traffic safety professionals
- Information available for program planning, implementation and evaluation

Who benefited and how:

The following organizations now have easy access to traffic records that are based on highest possible quality data to be used in program planning, implementation and evaluation. Previously, access to these data was limited and in some cases could not be accessed by anyone but the data owner.

- GHSB, a program of EOPS
- Massachusetts State Police
- MassHighway
- MassSAFE
- Metropolitan Planning Organizations (MPOs)
- State/Local Law Enforcement
- Engineers
- Traffic Records Professionals
- Medical Professionals
- Trauma Care Providers
- Public Health Officials
- Community Organizations
- State/Local Traffic Safety Researchers

Part Two: Project Detail

Project Description

This project has been undertaken through the concurrent development of two components: the Massachusetts Data Warehouse and the Interactive Data Retrieval System.

The Massachusetts Data Warehouse houses data from multiple data sources for use in highway safety data analysis, problem identification, program planning, and program evaluation. Data included in the Massachusetts Data Warehouse underwent a multi-step cleaning and loading process to improve data quality before it is accessible to analysts, researchers or query tool users.

The Interactive Data Retrieval System with Online Query Tools was developed to allow users to access crash data in the Massachusetts Data Warehouse via the Internet. The Online Query Tools provide users with three ways to access data: EasyChart, Query Tool, and Ad Hoc Query Tool.

- **EasyChart** creates charts of data from the Massachusetts Data Warehouse that show trends in crashes and crash-related injuries by community, county, and throughout the Commonwealth. Results are provided in an easy-to understand format.

- **Query Tool** creates tables, charts, maps, or exports the result set as a CSV file by univariant or bivariate tables. This tool, however, does not allow filtering on any specific attribute or field.

- **Ad Hoc Query System** has the ability to apply filter(s) to the data and produce tables, charts, maps, or export the data as a CSV file by univariant or multivariate queries.

Relation of Project to National Agenda Goals Listed in Part One

Goal 1: Involve a leader who promotes the importance of highway safety information systems, used for safety policy and program decision making. The Massachusetts Data Warehouse and Interactive Data Retrieval System is a project of, and has been promoted by, the GHSB, a program of EOPS. They have taken on the traffic records role of making highway safety data available to all key stakeholders in Massachusetts to be used in developing policy and program decision making.

Goal 2: Involve the coordination of the collection, management, and use of highway safety information among various organizations responsible for highway transportation policy. The GHSB, a program of EOPS, coordinates the collection, management and use of highway safety information. More than 50 agencies are now using the data available through the Massachusetts Data Warehouse. The cooperation of agencies in providing data, some of which is heavily protected by privacy legislation, underlines their commitment to the importance of maintaining a central data repository. Support by the agencies for the creation and fine-tuning of the Interactive Data Retrieval System highlights the importance placed on not only housing the data in a central location but ensuring key policy-makers and decision-makers have easy access to the data.

Goal 3: Represent an example of integrating the planning of highway safety programs with highway safety information systems. The FY2004 Massachusetts Highway Safety Plan, was heavily dependent on analysis of data from the Massachusetts Data Warehouse. MassHighway has used the Massachusetts Data Warehouse to plan their role as a lead state implementing run-off-the-road prevention options for the American Association of State Highway and Transportation Officials (AASHTO) Strategic Highway Safety Plan. Massachusetts State Police Commercial Vehicle Enforcement Service used the Massachusetts Data Warehouse to allocate resources for commercial vehicle enforcement.

Goal 4: Represent an example where managers and users of highway safety information have utilized or were provided the necessary resources to select the appropriate technology to meet their information needs. Managers and users of the Massachusetts Data Warehouse system were included in every step of the development of the system. Through their input, the system has incorporated transportation safety related functions that allow a customized access to the data residing in the warehouse. The result is a tool uniquely tailored to the needs of transportation safety. This collaboration included spending time educating all of the people involved. The technical staff spent time learning and reviewing the unique needs of the transportation professional. The same time was spent educating the same professionals on the possibilities and limitations of the current technology available to the project.

Goal 5: Represent examples of highway safety professionals being trained in the analytic methods appropriate for evaluation of highway safety information. The Interactive Data Retrieval System provides the resources necessary for highway safety professionals to access and analyze data regardless of their data analysis experience or skill level. Providing analysis tools for basic, mid-level and in-depth data analysis ensures that not only will the data be centrally stored, but it can be accessed by users at all skill levels. Interactive Data Retrieval System users can attend training sessions on using the Online Query Tools and interpreting the results.

Support of Project for Management Steps Listed in Part One

(1) Establish Safety Goals The Massachusetts Data Warehouse and Interactive Data Retrieval System provides the data used for establishing Massachusetts safety goals for the annual Highway Safety Plan. It has also been the source of information for problem identification and goal setting for Massachusetts role in the implementation of the AASHTO Strategic Highway Safety Plan.

(2) Identify Problems The Massachusetts Data Warehouse and Interactive Data Retrieval System have been the basis of problem identification for Massachusetts program design/implementation. The MSP has used it to identify problem areas in commercial vehicle safety to optimize resource allocation. MassSAFE has used it to identify problem areas in terms of inpatient discharge charges associated with Massachusetts crashes. In addition, it has been used by the University of Massachusetts Transportation Center to identify problem areas for traffic safety engineering research. Data from the Massachusetts Data Warehouse has also been used to answer more then the 70 data requests from traffic safety stakeholders seeking information for problem identification. Several University research programs have used the Massachusetts Data Warehouse to identify problems areas and research topics.

(3) Plan Programs/Countermeasures Organizations/agencies that have used the Massachusetts Data Warehouse and Interactive Data Retrieval System for program and policy planning include the GHSB, a program of EOPS, Students Against Destructive Decisions (SADD), MassHighway and the MSP, MPOs and municipal transportation commissions, and the SAFE Coalition whose efforts are focused on work to pass a primary seat belt use law in Massachusetts. Data from the Massachusetts Data Warehouse was also used for Child Passenger Safety Week.

(4) Implement Programs The Massachusetts Data Warehouse and Interactive Data Retrieval System have been used by the GHSB, a program of EOPS, to rank communities should receive grant disbursement. It has been used by MSP to determine where to deploy enforcement.

(6) Evaluate Effectiveness The Massachusetts Data Warehouse and Interactive Data Retrieval System have been used Massachusetts organizations to understand the effectiveness of programs by analyzing data to determine whether established safety goals have been met. It was as part of the evaluation of statewide "Click It or Ticket" and "You Drink and Drive. You Lose" campaigns. As it is a relatively new resource for Massachusetts, many of the programs that were designed using the Massachusetts Data Warehouse are still being implemented. It is anticipated that once those are complete, and as new data-driven programs are designed, there will be an increase in the use of the Massachusetts Data Warehouse for evaluation purposes.

Major process steps for project, including unique aspects that enhanced success

1. Gather support of data owners and build on support to obtain data.
2. Create Massachusetts Data Warehouse framework that allows all types of crash-related data to be stored in one location.
3. Obtain, prepare and load data in to Massachusetts Data Warehouse to ensure highest possible data quality.
4. Create Interactive Data Retrieval System.
5. Beta test Interactive Data Retrieval System. Improve System based on feedback.
6. Promote and encourage use of the Massachusetts Data Warehouse and Interactive Data Retrieval System.

Provide the evidence and reasoning used to determine the success of the project

Currently, the Massachusetts Data Warehouse houses data from six different state agencies with the addition of more being anticipated in the near future. This is a testament to the success of inviting a variety of agencies to collaborate on one project. Data is being accessed by 50 agencies for program planning, implementation, and evaluation. The success of this project is also measured by its continuous growth and expansion. It has unlimited potential in terms of additional databases to be added and accessed by users; there has been active pursuit of obtaining additional databases for inclusion. It is anticipated that access to this variety of data will ultimately lead to programs that are better planned and therefore are successful in the ultimate goal of reducing the frequency and severity of crashes. Once the programs that were designed using the Massachusetts Data Warehouse, which are currently being implemented, have been complete, the tangible benefits of having this data centralized and accessible will be easier to quantify.

Why should this project be recognized as a best practice in traffic records?

The Massachusetts Data Warehouse and Interactive Data Retrieval System are **versatile** and **diverse** to meet the varied and changing needs of the traffic records and transportation safety communities**.**

- The Massachusetts Data Warehouse framework is designed to house any crash-related data set including those both data traditionally associated with traffic records such as crash data and license information as well as less traditional data sets including medical data, fire department data, and inspection data.

- The Massachusetts Data Warehouse and Interactive Data Retrieval System serve a myriad of traffic safety stakeholders, as described in the Summary of Project Benefits. Queries and results can be customized to meet user needs based on location, data needs, and anticipated end-use of query results. Each users online experience can be personalized in terms of access to data, ability to save previous queries and filters and query result format.

- The Massachusetts Data Warehouse and Interactive Data Retrieval System currently house ten different data sets covering more than 60 cumulative years of crash-related data.

The Massachusetts Data Warehouse and Interactive Data Retrieval System are **easy-to-use** and have **practical** "real world" application.

- The Interactive Data Retrieval System provides access to three Online Query Tools designed to maximize the experience for users at all skill levels of data analysis.

- Users need only standard internet access to use the Interactive Data Retrieval System. This allows users to access previously unavailable crash-related data using only a standard computer. There is no need for powerful hardware or special software.

- Data analysis and query results from the Massachusetts Data Warehouse and Interactive Data Retrieval System have already been used by all three "E"s of traffic safety: engineering, education and enforcement. MassHighway has used the Massachusetts Data Warehouse as part of it role as a lead state in implementing run-off-the-road prevention methods from the AASHTO Strategic Highway Safety Plan. SADD has used and will continue to use the data to evaluate its high school education programs. The MSP Commercial Vehicle Enforcement Service has used it in resource allocation for

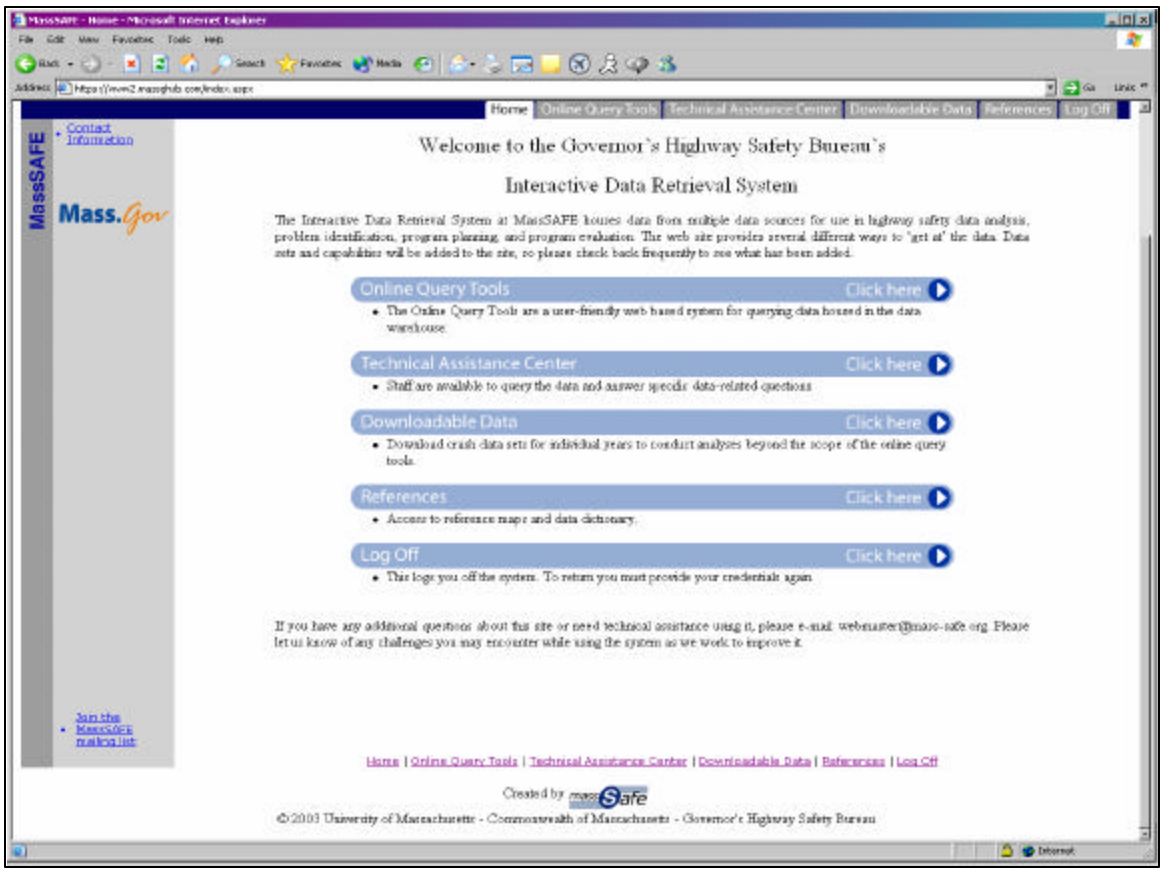
commercial motor vehicle enforcement. As the number of users increases and the amount and type of data available is expanded, this application of data to program planning, implementation and evaluation will become more widespread.

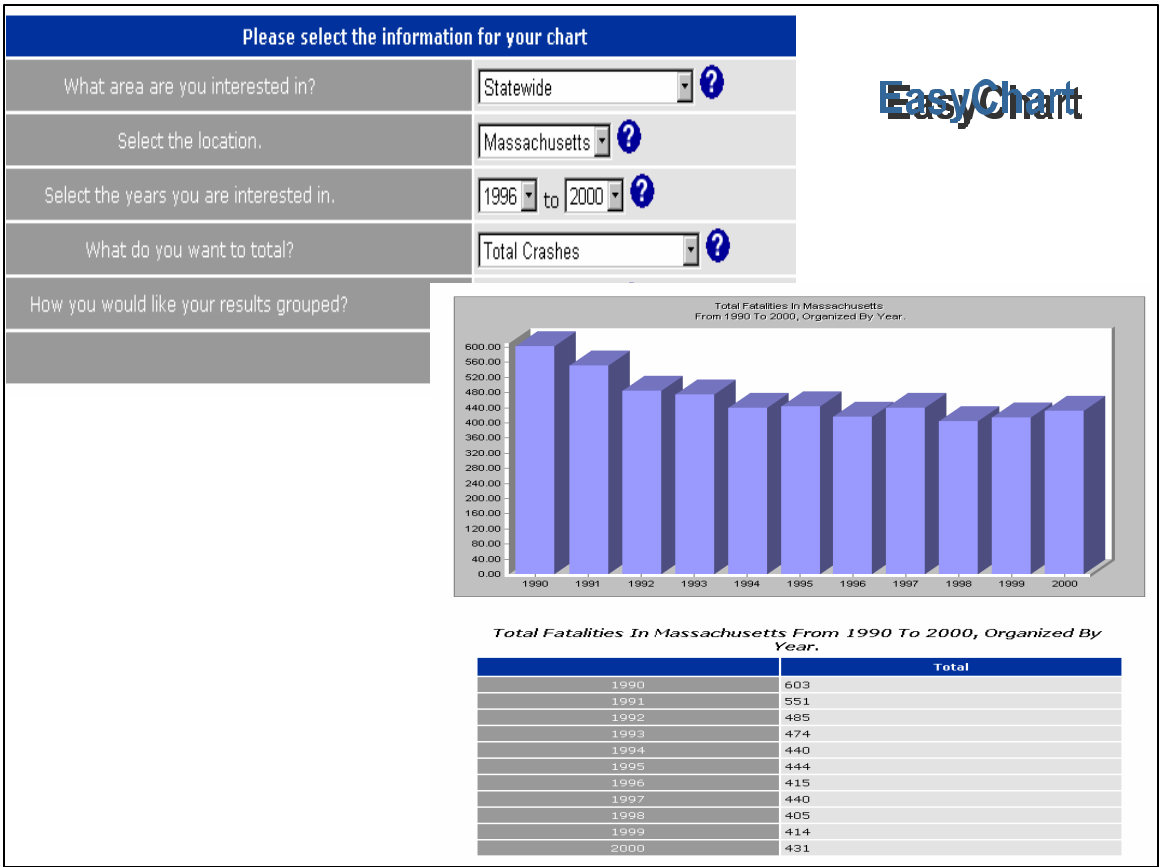
The Massachusetts Data Warehouse and Interactive Data Retrieval System uses **state-of-the-art** hardware, software, and computing theories to create a unique, maximized experience for users that requires no special equipment or software on the user end.

- The warehouse is built using Oracle databases for access to large and complex sets of data. Using Oracle for data access allows the system to aggregate and calculate multi-million row queries in minutes instead of hours. Oracle is the state of the art relational data management system and is used for all of the data needs in the warehouse.

- The web interface is based on Microsoft's IIS and .NET technology. This is the newest web technology available and allows rapid development as well as presenting the end users with a desktop application look and feel served over traditional HTML and a web browser. This increases the circle of influence the application has to any person with a web browser. This opens data access to individuals who previously were unable to have access to the data sources in our system.

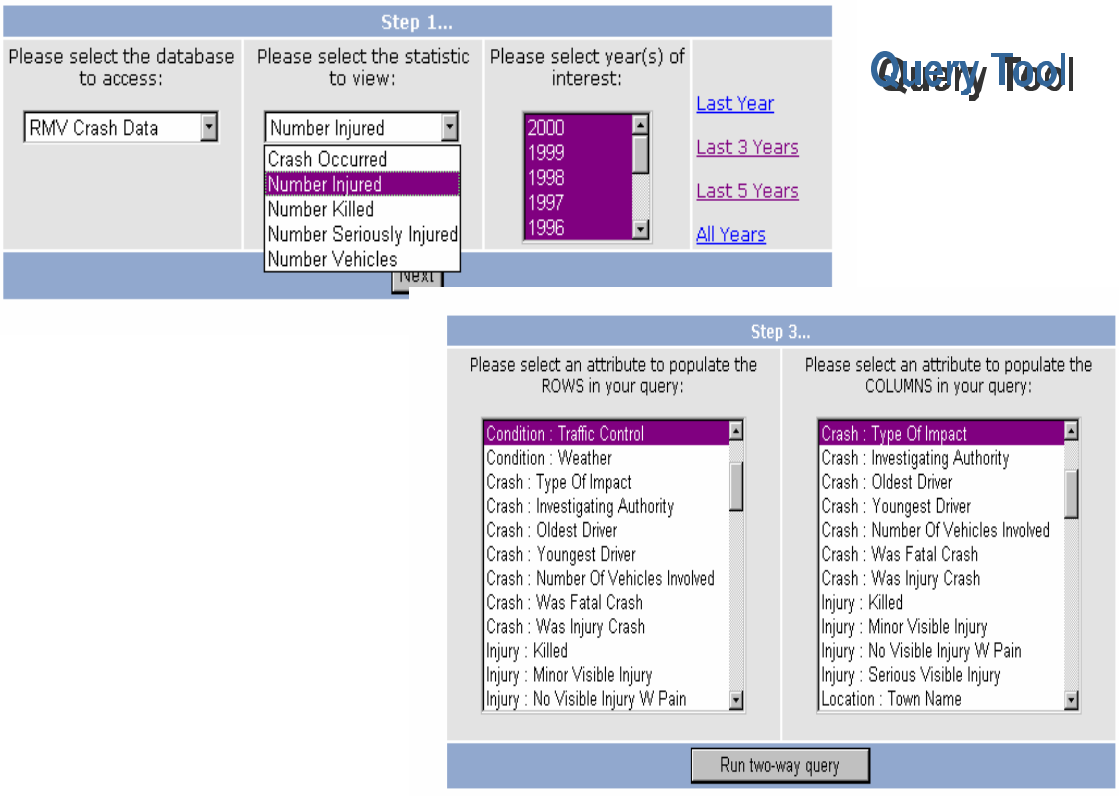
APPENDIX: Screen Shots of the Interactive Data Retrieval System





Total Fatalities In Massachusetts From 1990 To 2000, Organized By Year.

	Total
1990	603
1991	551
1992	485
1993	474
1994	440
1995	444
1996	415
1997	440
1998	405
1999	414
2000	431



Total Number Injured grouped by Condition : Traffic Control, Crash : Type Of Impact for the year(s) 1996, 1997, 1998, 1999, 2000.

Step 4...

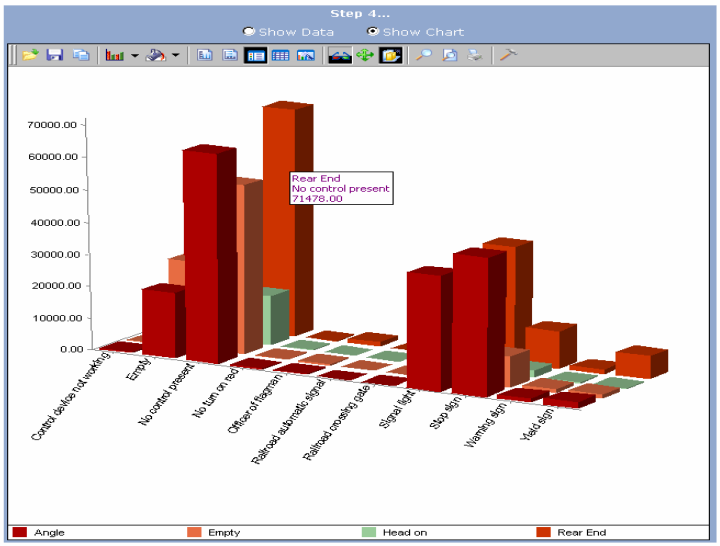
The data returned from your query is shown below. You may view a chart of the data by clicking on the 'Show Chart' button, or, if you selected a location field, you may view a map of the data by clicking the 'Show Map' button.

Show Data Show Chart

Crash : Type Of Impact / Condition : Traffic Control	Angle	Empty	Head on	Rear End
Control device not working	428	192	52	258
Empty	20590	27819	3637	29022
No control present	65023	52968	15680	71478
No turn on red	324	272	88	355
Officer of flagman	248	342		
Railroad automatic signal	55	40		
Railroad crossing gate	47	71		
Signal light	35284	12320		
Stop sign	42649	9593		
Warning sign	1313	1152		

Query Tool

Total Number Injured grouped by Condition : Traffic Control, Crash : Type Of Impact for the year(s) 1996, 1997, 1998, 1999, 2000.



Total Accidents for the year(s) 2002.

Step 1: Data Source | Step 2: Filters | Step 3: Table Layout | Step 4: Results

Please select data source to use:	Please select the function to apply to the results:	Please select the statistic to view:	Please select the years of interest:
CMV Accident Data	Total	Accidents	2002
CMV Inspection Data	Average	Fatalities	2001
RMV Citation Data		Injuries	2000
RMV Crash Data		Vehicles Involved	1999
RMV Injury Data			1998
RMV Operator Data			1997
			1996
			1995

Last Year

Last 3 Years

Last 5 Years

All

Ad Hoc Query Tool

Total Accidents where Accident : Accident Citatation Issued Equal to 'Yes' AND Accident : Injuries Greater than or equal to 1 for the year(s) 2002.

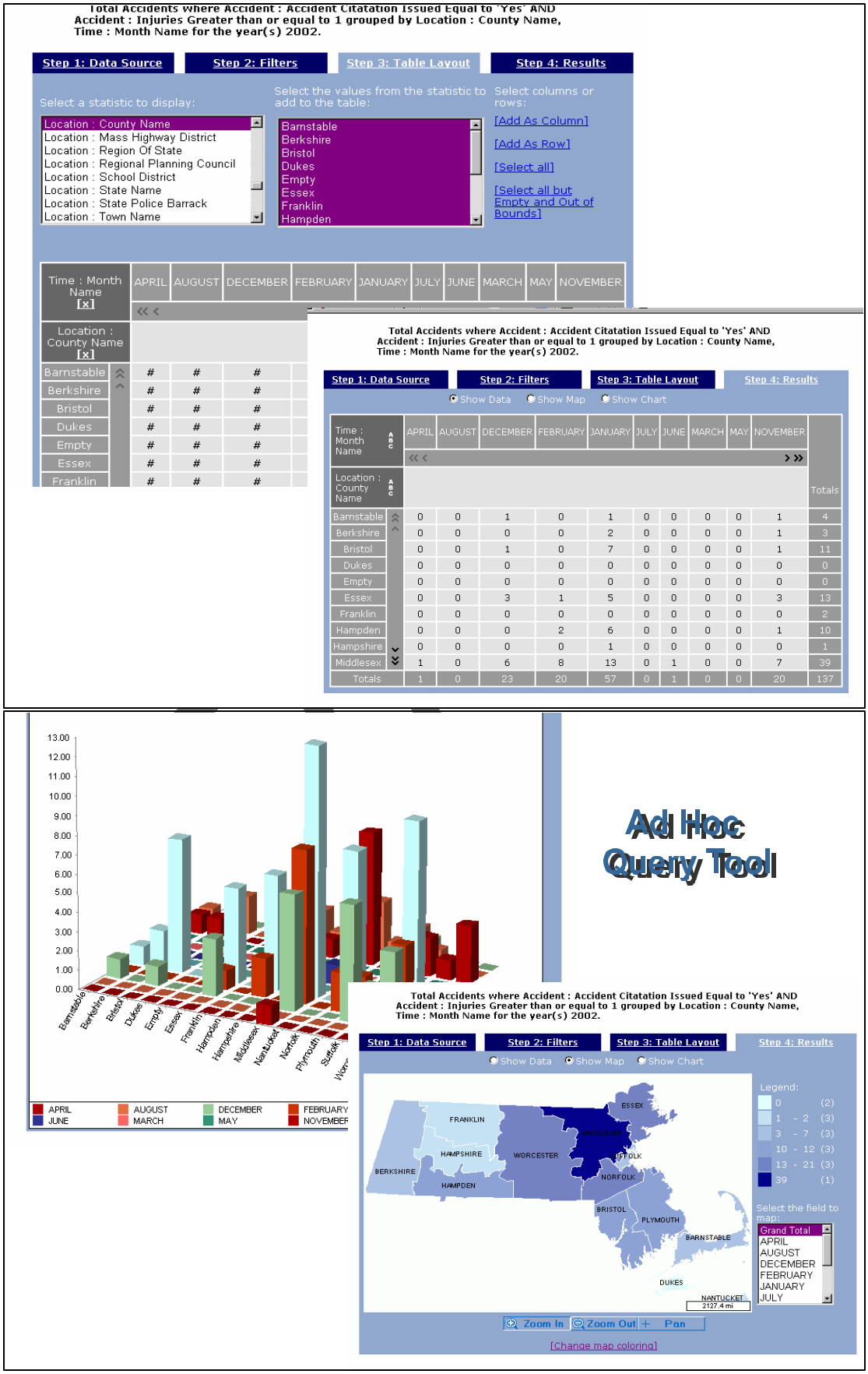
Step 1: Data Source | Step 2: Filters | Step 3: Table Layout | Step 4: Results

Select the attribute that you wish to filter:	Select the comparison operator:	Select the values to compare:
Accident : Injuries	Equal to	0
Accident : Light Condition	Not equal to	1
Accident : Reporting Agency	Greater than	2
Accident : Road Surface Condition	Greater than or equal to	3
Accident : State Reportable	Less than	4
Accident : Towaway	Less than or equal to	5
Accident : Trafficway		6
Accident : Vehicles		7

Load Filter Add Filter

Group	Text	Move	Ungroup	Remove
	Accident : Accident Citatation Issued Equal to 'Yes'			[Remove]
	And / Or			
	Accident : Injuries Greater than or equal to 1			[Remove]

Add Group Save Filter


Total Accidents where Accident : Accident Citation Issued Equal to 'Yes' AND Accident : Injuries Greater than or equal to 1 grouped by Location : County Name, Time : Month Name for the year(s) 2002.
Step 1: Data Source
Step 2: Filters
Step 3: Table Layout
Step 4: Results
Select a statistic to display:
Location : County Name
Location : Mass Highway District
Location : Region Of State
Location : Regional Planning Council
Location : School District
Location : State Name
Location : State Police Barrack
Location : Town Name
Select the values from the statistic to add to the table:
Barnstable
Berkshire
Bristol
Dukes
Empty
Essex
Franklin
Hampden
Select columns or rows:
[Add As Column]
[Add As Row]
[Select all]
[Select all but Empty and Out of Bounds]
Time : Month Name [x]
APRIL AUGUST DECEMBER FEBRUARY JANUARY JULY JUNE MARCH MAY NOVEMBER
Location : County Name [x]
Barnstable
Berkshire
Bristol
Dukes
Empty
Essex
Franklin
Total Accidents where Accident : Accident Citation Issued Equal to 'Yes' AND Accident : Injuries Greater than or equal to 1 grouped by Location : County Name, Time : Month Name for the year(s) 2002.
Step 1: Data Source
Step 2: Filters
Step 3: Table Layout
Step 4: Results
Show Data
Show Map
Show Chart
Time : Month Name
Location : County Name
APRIL AUGUST DECEMBER FEBRUARY JANUARY JULY JUNE MARCH MAY NOVEMBER Totals
Barnstable 0 0 1 0 1 0 0 0 0 1 4
Berkshire 0 0 0 0 2 0 0 0 0 1 3
Bristol 0 0 1 0 7 0 0 0 0 1 11
Dukes 0 0 0 0 0 0 0 0 0 0 0
Empty 0 0 0 0 0 0 0 0 0 0 0
Essex 0 0 3 1 5 0 0 0 0 3 13
Franklin 0 0 0 0 0 0 0 0 0 0 2
Hampden 0 0 0 2 6 0 0 0 0 1 10
Hampshire 0 0 0 0 1 0 0 0 0 0 1
Middlesex 1 0 6 8 13 0 1 0 0 7 39
Totals 1 0 23 20 57 0 1 0 0 20 137
13.00
12.00
11.00
10.00
9.00
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
Barnstable Berkshire Bristol Dukes Empty Essex Franklin Hampden Hampshire Middlesex Nantucket Norfolk Plymouth Suffolk
APRIL AUGUST DECEMBER FEBRUARY
JUNE MARCH MAY NOVEMBER
Ad Hoc Query Tool
Total Accidents where Accident : Accident Citation Issued Equal to 'Yes' AND Accident : Injuries Greater than or equal to 1 grouped by Location : County Name, Time : Month Name for the year(s) 2002.
Step 1: Data Source
Step 2: Filters
Step 3: Table Layout
Step 4: Results
Show Data
Show Map
Show Chart
FRANKLIN
HAMPSHIRE
BERKSHIRE
HAMPDEN
WORCESTER
ESSEX
MIDDLESEX
SUFFOLK
NORFOLK
BRISTOL
PLYMOUTH
BARNSTABLE
DUKES
NANTUCKET
2127.4 mi
Legend:
0 (2)
1 - 2 (3)
3 - 7 (3)
10 - 12 (3)
13 - 21 (3)
39 (1)
Select the field to map:
Grand Total
APRIL
AUGUST
DECEMBER
FEBRUARY
JANUARY
JULY
Zoom In
Zoom Out
Pan
[Change map coloring]